

# NTR4502P, NVTR4502P

## MOSFET – Power, Single, P-Channel, SOT-23

**-30 V, -1.95 A**



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### Features

- Leading Planar Technology for Low Gate Charge/Fast Switching
- Low  $R_{DS(on)}$  for Low Conduction Losses
- SOT-23 Surface Mount for Small Footprint (3 x 3 mm)
- NV Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q101 Qualified and PPAP Capable
- These Devices are Pb-Free and are RoHS Compliant

### Applications

- DC to DC Conversion
- Load/Power Switch for Portables and Computing
- Motherboard, Notebooks, Camcorders, Digital Camera's, etc.
- Battery Charging Circuits

### MAXIMUM RATINGS ( $T_J = 25^\circ\text{C}$ unless otherwise stated)

| Parameter   | Symbol                   | Value                    | Unit             |                  |
|---|--------------------------|--------------------------|------------------|------------------|
| Drain-to-Source Voltage   | $V_{DSS}$                | -30                      | V                |                  |
| Gate-to-Source Voltage  | $V_{GS}$                 | $\pm 20$                 | V                |                  |
| Drain Current (Note 1)  | $t < 10$ s               | $T_A = 25^\circ\text{C}$ | $I_D$ -1.95      | A                |
|   |                          | $T_A = 70^\circ\text{C}$ |                  | -1.56            |
| Power Dissipation (Note 1)  | $t < 10$ s               | $P_D$                    | 1.25             | W                |
| Continuous Drain Current (Note 1)                                   | Steady State             | $T_A = 25^\circ\text{C}$ | $I_D$ -1.13      | A                |
|   |                          | $T_A = 70^\circ\text{C}$ |                  | -0.90            |
| Power Dissipation (Note 1)  | Steady State             | $P_D$                    | 0.4              | W                |
| Pulsed Drain Current  | $t_p = 10$ $\mu\text{s}$ | $I_{DM}$                 | -6.8             | A                |
| Operating Junction and Storage Temperature                          | $T_J, T_{STG}$           | -55 to 150               |                  | $^\circ\text{C}$ |
| Source Current (Body Diode)   | $I_S$                    | -1.25                    | A                |                  |
| Lead Temperature for Soldering Purposes (1/8 in from case for 10 s) | $T_L$                    | 260                      | $^\circ\text{C}$ |                  |

### THERMAL RESISTANCE RATINGS

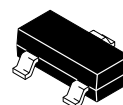
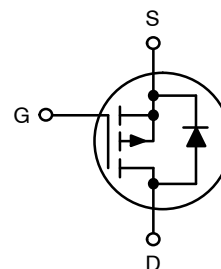
| Parameter                                   | Symbol          | Max | Unit                      |
|---|-----------------|-----|---------------------------|
| Junction-to-Ambient – Steady State (Note 1) | $R_{\theta JA}$ | 300 | $^\circ\text{C}/\text{W}$ |
| Junction-to-Ambient – $t = 10$ s (Note 1)   | $R_{\theta JA}$ | 100 |                           |

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

1. Surface-mounted on FR4 board using 1 in sq. pad size (Cu area = 1.127 in sq. [1 oz] including traces).

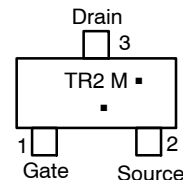
| $V_{(BR)DSS}$ | $R_{DS(on)}$ TYP        | $I_D$ Max (Note 1) |
|---------------|-------------------------|--------------------|
| -30 V         | 155 m $\Omega$ @ -10 V  | -1.95 A            |
|               | 240 m $\Omega$ @ -4.5 V |                    |

### P-Channel MOSFET



**SOT-23  
CASE 318  
STYLE 21**

### MARKING DIAGRAM/ PIN ASSIGNMENT



TR2 = Device Code  
M = Date Code\*  
▪ = Pb-Free Package

(Note: Microdot may be in either location)

\*Date Code orientation and/or overbar may vary depending upon manufacturing location.

### ORDERING INFORMATION

| Device       | Package          | Shipping†          |
|--------------|------------------|--------------------|
| NTR4502PT1G  | SOT-23 (Pb-Free) | 3000 / Tape & Reel |
| NVTR4502PT1G | SOT-23 (Pb-Free) | 3000 / Tape & Reel |

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

# NTR4502P, NVTR4502P

## Electrical Characteristics ( $T_J = 25^\circ\text{C}$ unless otherwise specified)

| Parameter | Symbol | Test Condition | Min | Typ | Max | Unit |
|-----------|--------|----------------|-----|-----|-----|------|
|-----------|--------|----------------|-----|-----|-----|------|

### OFF CHARACTERISTICS

|                                   |               |   |                          |  |           |               |
|-----------------------------------|---------------|---|--------------------------|--|-----------|---------------|
| Drain-to-Source Breakdown Voltage | $V_{(BR)DSS}$ | $V_{GS} = 0\text{ V}, I_D = -250\ \mu\text{A}$  | -30                      |  |           | V             |
| Zero Gate Voltage Drain Current   | $I_{DSS}$     | $V_{GS} = 0\text{ V}, V_{DS} = -30\text{ V}$    | $T_J = 25^\circ\text{C}$ |  | -1        | $\mu\text{A}$ |
|                                   |               |   | $T_J = 55^\circ\text{C}$ |  | -10       |               |
| Gate-to-Source Leakage Current    | $I_{GSS}$     | $V_{DS} = 0\text{ V}, V_{GS} = \pm 20\text{ V}$ |                          |  | $\pm 100$ | nA            |

### ON CHARACTERISTICS (Note 3)

|                               |              |   |      |     |      |            |
|-------------------------------|--------------|---|------|-----|------|------------|
| Gate Threshold Voltage        | $V_{GS(TH)}$ | $V_{GS} = V_{DS}, I_D = -250\ \mu\text{A}$    | -1.0 |     | -3.0 | V          |
| Drain-to-Source On Resistance | $R_{DS(on)}$ | $V_{GS} = -10\text{ V}, I_D = -1.95\text{ A}$ |      | 155 | 200  | m $\Omega$ |
|                               |              | $V_{GS} = -4.5\text{ V}, I_D = -1.5\text{ A}$ |      | 240 | 350  |            |
| Forward Transconductance      | $g_{FS}$     | $V_{DS} = -10\text{ V}, I_D = -1.25\text{ A}$ |      | 3   |      | S          |

### CHARGES AND CAPACITANCES

|                              |              |  |  |     |    |    |
|------------------------------|--------------|--|--|-----|----|----|
| Input Capacitance            | $C_{ISS}$    | $V_{GS} = 0\text{ V}, f = 1\text{ MHz}, V_{DS} = -15\text{ V}$       |  | 200 |    | pF |
| Output Capacitance           | $C_{OSS}$    |  |  | 80  |    |    |
| Reverse Transfer Capacitance | $C_{RSS}$    |  |  | 50  |    |    |
| Total Gate Charge            | $Q_{G(TOT)}$ | $V_{GS} = -10\text{ V}, V_{DS} = -15\text{ V}; I_D = -1.95\text{ A}$ |  | 6   | 10 | nC |
| Threshold Gate Charge        | $Q_{G(TH)}$  |  |  | 0.3 |    |    |
| Gate-to-Source Charge        | $Q_{GS}$     |  |  | 1   |    |    |
| Gate-to-Drain Charge         | $Q_{GD}$     |  |  | 1.7 |    |    |

### SWITCHING CHARACTERISTICS (Note 4)

|                     |              |   |  |      |    |    |
|---------------------|--------------|---|--|------|----|----|
| Turn-On Delay Time  | $t_{d(ON)}$  | $V_{GS} = -10\text{ V}, V_{DD} = -15\text{ V}, I_D = -1.95\text{ A}, R_G = 6\ \Omega$ |  | 5.2  | 10 | ns |
| Rise Time           | $t_r$        |   |  | 12   | 20 |    |
| Turn-Off Delay Time | $t_{d(OFF)}$ |   |  | 19   | 35 |    |
| Fall Time           | $t_f$        |   |  | 17.5 | 30 |    |

### DRAIN-SOURCE DIODE CHARACTERISTICS (Note 3)

|                       |          |  |  |      |      |    |
|-----------------------|----------|--|--|------|------|----|
| Forward Diode Voltage | $V_{SD}$ | $V_{GS} = 0\text{ V}, I_S = -1.25\text{ A}$  |  | -0.8 | -1.2 | V  |
| Reverse Recovery Time | $t_{RR}$ | $V_{GS} = 0\text{ V}, dI_{SD}/dt = 100\text{ A}/\mu\text{s}, I_S = -1.25\text{ A}$ |  | 23   |      | ns |

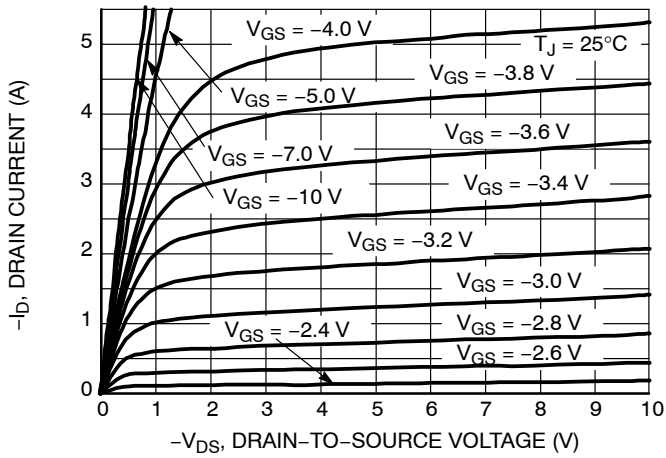
Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

2. Surface-mounted on FR4 board using 1 in sq. pad size (Cu area = 1.127 in sq. [1 oz] including traces).

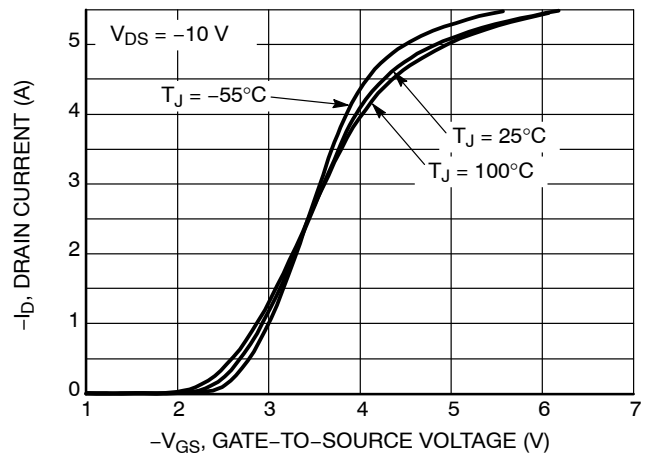
3. Pulse Test: pulse width  $\leq 300\ \mu\text{s}$ , duty cycle  $\leq 2\%$ .

4. Switching characteristics are independent of operating junction temperatures.

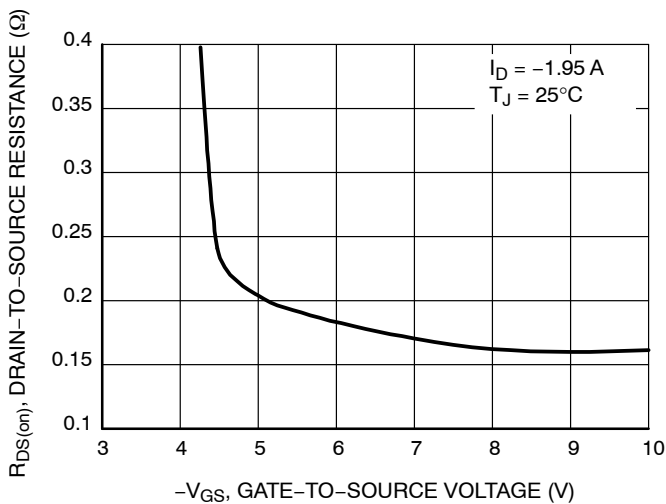
# NTR4502P, NVTR4502P



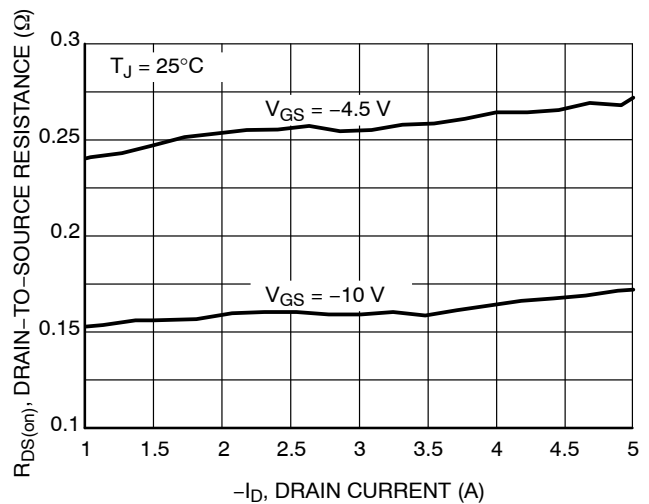
**Figure 1. On-Region Characteristics**



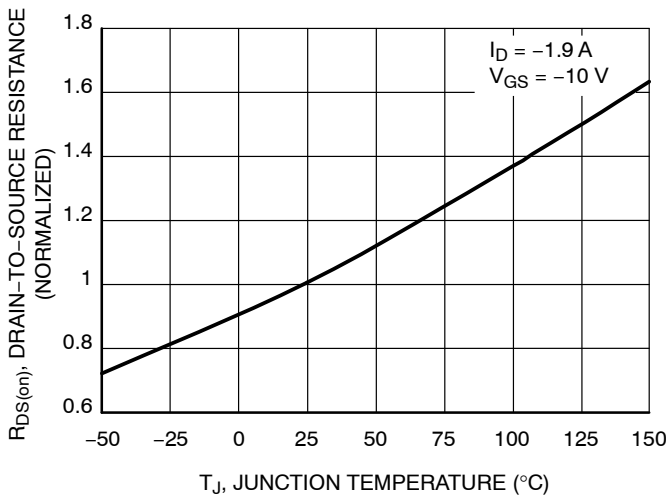
**Figure 2. Transfer Characteristics**



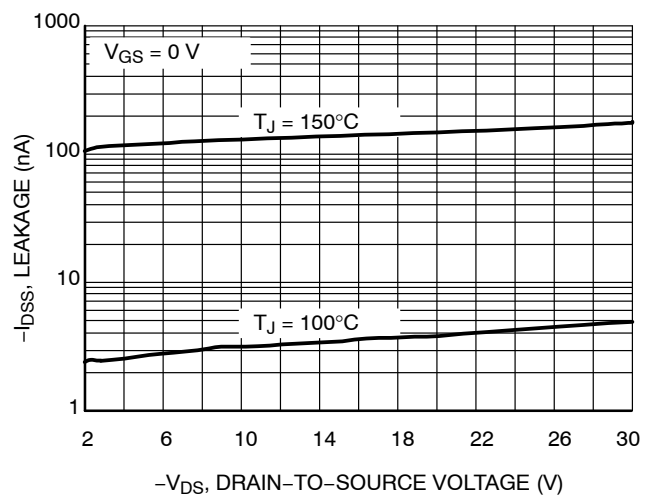
**Figure 3. On-Resistance versus Gate-to-Source Voltage**



**Figure 4. On-Resistance versus Drain Current and Gate Voltage**

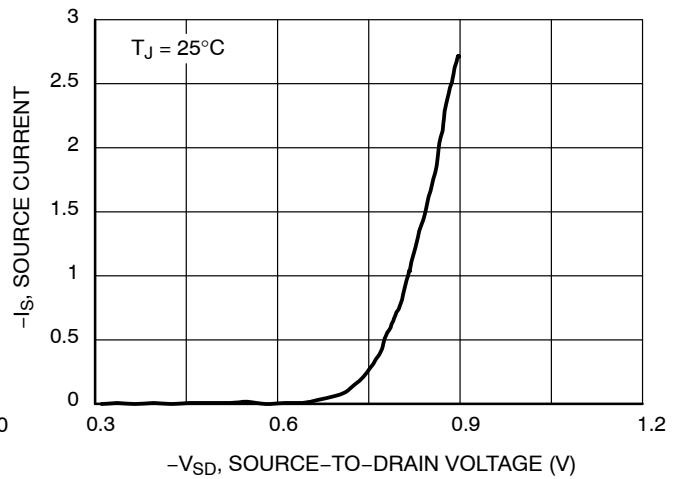
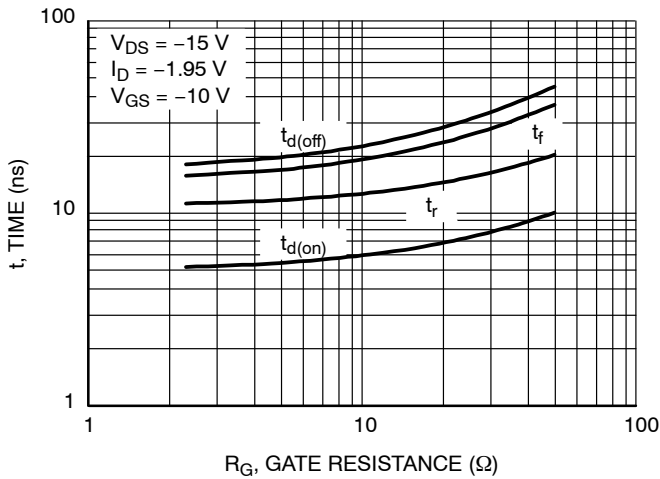
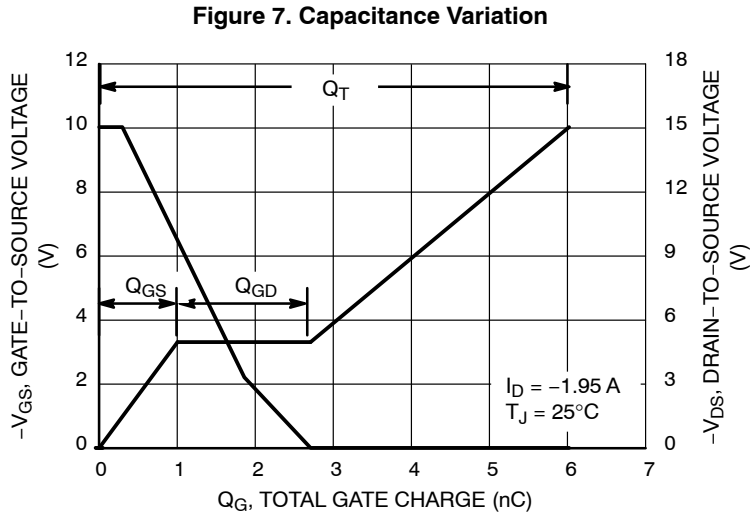
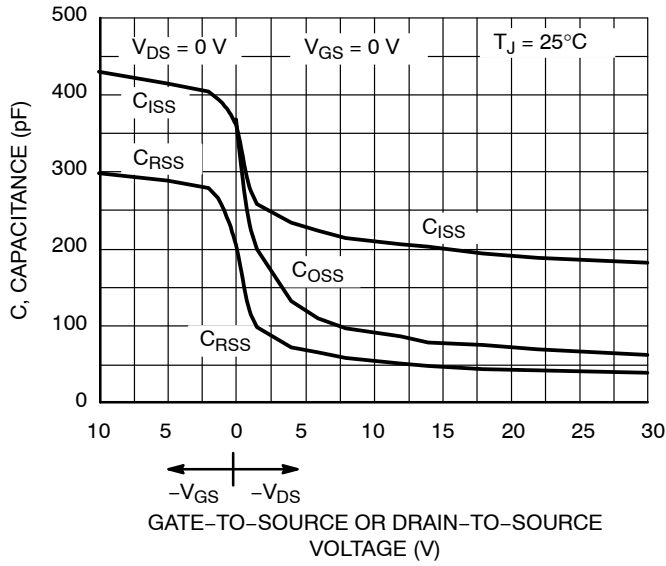


**Figure 5. On-Resistance Variation with Temperature**



**Figure 6. Drain-to-Source Leakage Current versus Voltage**

# NTR4502P, NVTR4502P



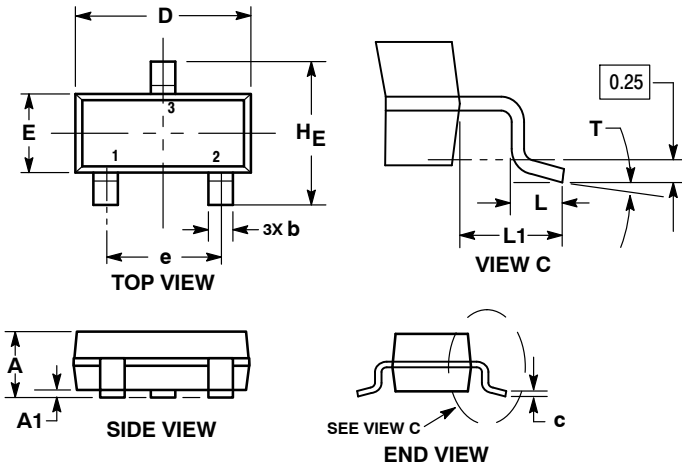
# NTR4502P, NVTR4502P

## PACKAGE DIMENSIONS

SOT-23 (TO-236)

CASE 318-08

ISSUE AR



**NOTES:**

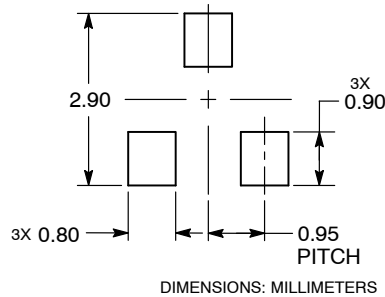
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF THE BASE MATERIAL.
4. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS.

| DIM | MILLIMETERS |      |      | INCHES |       |       |
|-----|-------------|------|------|--------|-------|-------|
|     | MIN         | NOM  | MAX  | MIN    | NOM   | MAX   |
| A   | 0.89        | 1.00 | 1.11 | 0.035  | 0.039 | 0.044 |
| A1  | 0.01        | 0.06 | 0.10 | 0.000  | 0.002 | 0.004 |
| b   | 0.37        | 0.44 | 0.50 | 0.015  | 0.017 | 0.020 |
| c   | 0.08        | 0.14 | 0.20 | 0.003  | 0.006 | 0.008 |
| D   | 2.80        | 2.90 | 3.04 | 0.110  | 0.114 | 0.120 |
| E   | 1.20        | 1.30 | 1.40 | 0.047  | 0.051 | 0.055 |
| e   | 1.78        | 1.90 | 2.04 | 0.070  | 0.075 | 0.080 |
| L   | 0.30        | 0.43 | 0.55 | 0.012  | 0.017 | 0.022 |
| L1  | 0.35        | 0.54 | 0.69 | 0.014  | 0.021 | 0.027 |
| HE  | 2.10        | 2.40 | 2.64 | 0.083  | 0.094 | 0.104 |
| T   | 0°          | ---  | 10°  | 0°     | ---   | 10°   |

**STYLE 21:**

1. GATE
2. SOURCE
3. DRAIN

### RECOMMENDED SOLDERING FOOTPRINT\*



\*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

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